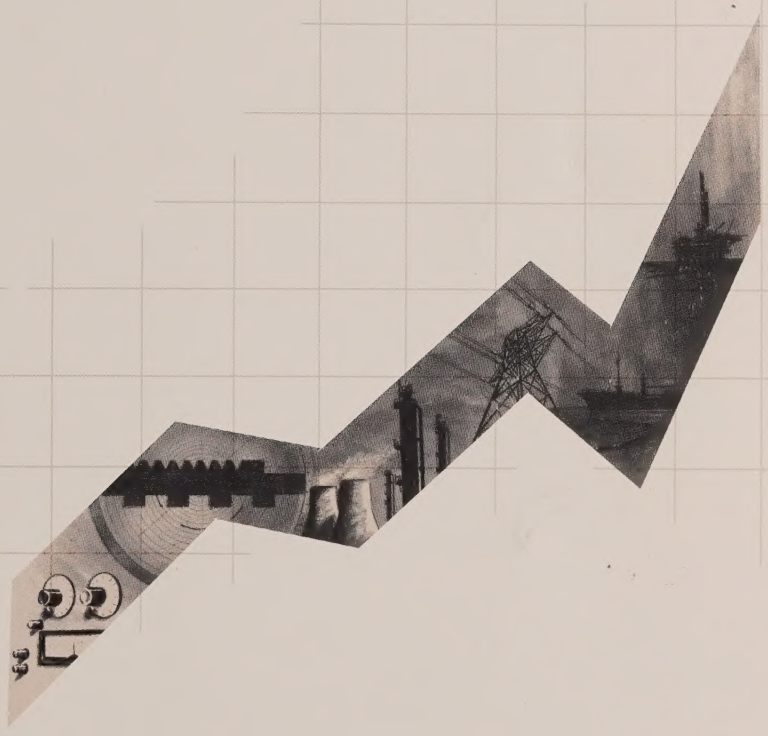
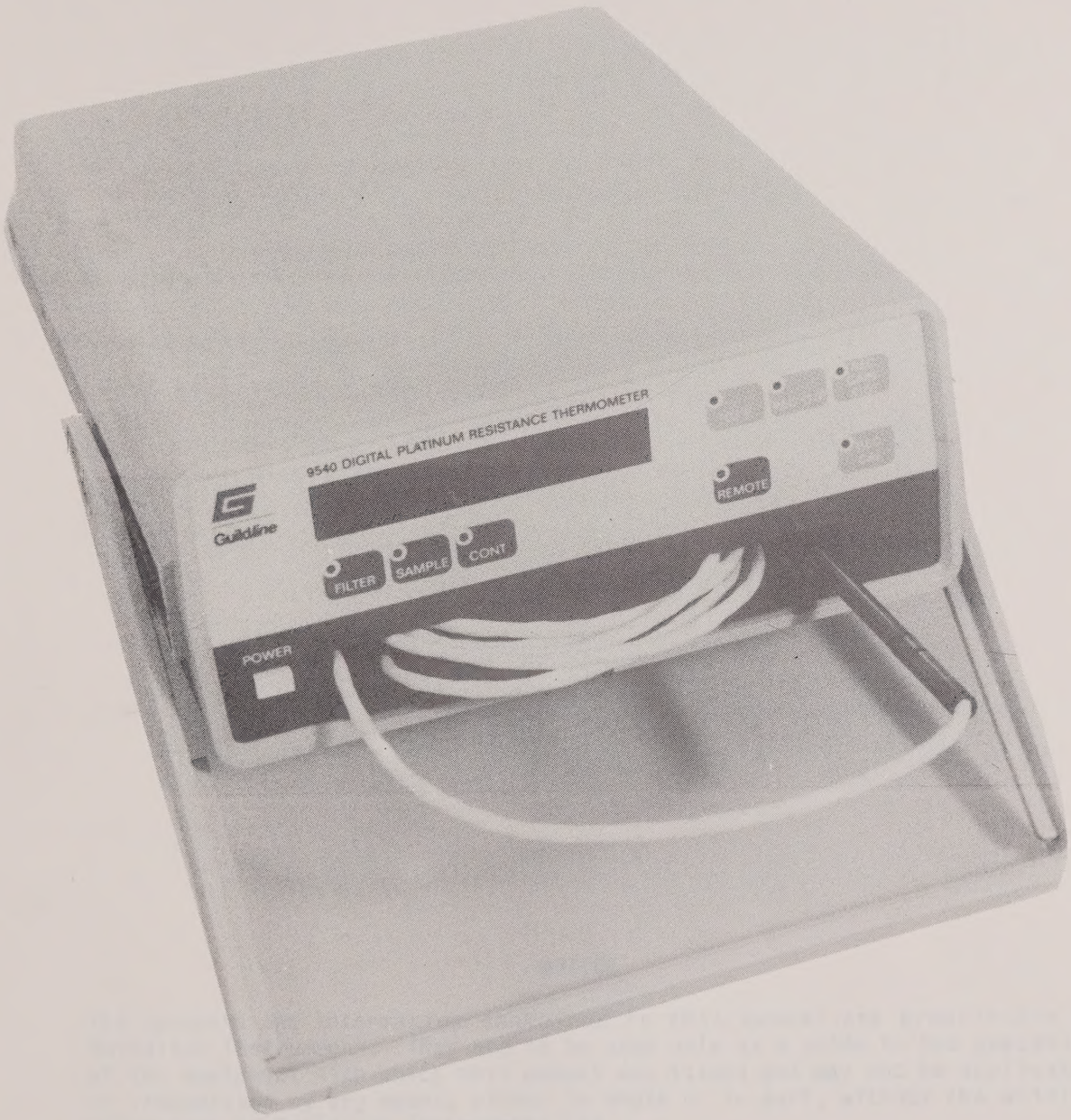
9540

Guildline



Operating
Manual

9540



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OM9540-A-02

Guildline

WARRANTY

Guildline Instruments warrants its products to be free of defects in manufacture and normal operation for a period of 12 months from the date of purchase. This warranty extends only to the original purchaser.

Equipment which is defective or fails within the warranty period will be repaired or replaced at our factory without charge at the discretion of Guildline Instruments. Charges for shipping by original order shipping methods and carrier insurance to and from our factory are included.

Warranty coverage includes field analysis and repair at the customer's option subject to the availability of personnel. Travel time and travel plus living expenses for field service are not covered.

In addition, systems engineered by Guildline Instruments are warranted to be free of defects in overall system operation for a period of 12 months from date of receipt by the original purchaser.

System components purchased by Guildline carry the warranty of the original equipment manufacturer and will be accepted for claim by Guildline Instruments at our factory only after warranty authorization by the original manufacturer.

Warranty coverage does not apply to equipment which has failed due to misuse, neglect, accident or abnormal conditions of operation or if modifications or repairs have been made without prior authorization of Guildline Instruments.

Fuses, lamps and non-rechargeable batteries are not warranted. Glassware is not warranted against breakage. Temperature probes are not warranted against failure due to mechanical shock.

DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER:
Instrument(s) should be thoroughly inspected immediately on receipt for visible damage. Any damage should be reported to the carrier and further inspection and operational tests should be carried out if appropriate to determine if there is internal damage. Normal repair procedures should then be followed. All final claims with the carrier must be completed by the purchaser.

Regular charges will apply to non warranty service.
External service charges and expenses will be billed at cost plus handling.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. **GUILDLINE INSTRUMENTS SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.**

REGISTRATION

In order to receive manual update information, technical bulletins and other publications we feel will make your task easier, please fill in and return the attached registration card. This will also validate your warranty.

For Service & Calibration see over.

October 1986

REGISTRATION

Instrument Model_____ Serial Number_____

Firm Name: _____

Address: _____

_____

_____

_____

Name of User_____

Your Application_____

_____

Signed_____ Date_____

Title _____

SERVICE & CALIBRATION

Before returning any equipment to us please obtain a return authorization number from Guildline Instruments either directly or through one of our representatives. This number must appear on all labels and all accompanying documentation otherwise shipping delays may occur. Shipments should be made by 'BEST WAY' prepaid.

Canada

•Contact Guildline Instruments Ltd., Canada
Tel: (613) 283-3000 •Telex: 053-3028
for authorization number and shipping instructions.

U.S.A.

•Contact Guildline Instruments Inc., USA
Tel: (305) 423-8215 •Telex: 856443
for authorization number and shipping instructions.

International

•Contact your local representative or Guildline Instruments Ltd., Canada
Tel: (613) 283-3000 •Telex: 053-3028
or write to P.O. Box 99, 21 Gilroy St.,
Smiths Falls, Ontario, Canada, K7A 4S9
for authorization number and shipping instructions.

Guildline

POSTAGE

GUILDINE INSTRUMENTS LTD.
P.O. BOX 99, 21 GILROY ST.
SMITHS FALLS, ONTARIO
CANADA

A D D E N D U M

Manual Number: OM9540-A-01

Details: Page 2-1, Temperature Table

RANGE	RESOLUTION C or F	24HRS. '23 C+/-1 C	90DAYS '23 C+/- C	1YEAR '23 C+/- C
+180 C to +240 C (+356 F to +464 F)	0.001	0.015	0.03	0.05
-40 C to +180 C (-40 F to +356 F)	0.001	0.01	0.015	0.03
-40 C (-40 F)	0.001	0.01	0.015	0.03
-41 C to -100 C (-41 F to -148 F)	0.001	0.01 +0.002/DEG	0.015 +0.002/DEG	0.03 +0.002/DEG
-100 C (-148 F)	0.001	0.1	0.115	0.13
-101 C to -200 C (-149 F to -328 F)	0.001	0.1 +0.02/DEG	0.115 +0.02/DEG	0.13 +0.02/DEG

A D D E N D U M

Manual Number: OM9540-A-01

Details:

Page 3-4, OPERATING PROCEDURE,

add: NOTE: If the line power is switched off and on in under 2 seconds, the microprocessor could latch up. If this condition should occur, switch the power off, wait 2 seconds and then switch the power on.

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RECEIPT AND INSPECTION

GENERAL

Remove the instrument from its shipping container. The instrument was thoroughly tested and inspected before shipment and should be free from any electrical or mechanical damage when received. Nevertheless, you should perform an inspection for physical damage, ensure all items on the packing list are present and test the instrument, electrically, as soon as possible after receipt. Refer to the warranty card at the front of the manual if any damage or deficiencies are found.

WARRANTY REGISTRATION

The warranty card found at the front of the manual should be completed and returned to Guildline Instruments immediately for registration. The completion and return of this card will ensure that all Field Service Bulletins and Technical Manual Addenda are forwarded to you.

SHIPPING CONTAINER

We recommend that the shipping container be retained for future storage or transportation of this instrument.

Chapter 1
Introduction

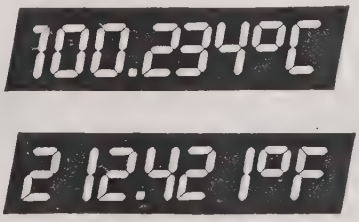
The Model 9540 Digital Thermometer is a microprocessor based instrument used for the precise measurement of temperature.

The measurement facilities are:

temperature in degrees centigrade from -200°C to +240°C
temperature in degrees fahrenheit from -328°F to +464°F

When the instrument is switched on an automatic self test is performed. The display will show each segment of the display being lit as an sequentially from left to right; minus sign, decimal point and degrees sign; all annunciators lit and GP-IB address is confirmed. The self test is concluded by the instrument indicating temperature in degrees centigrade.

The displayed measurement can be read directly in degrees centigrade or degrees fahrenheit with annunciation indicated in the display area.

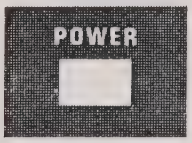


The displays above are typical for a given measurement.

CONTROLS

With the exception of Power on/off, all front panel controls are of the membrane switch type, an LED is incorporated in each switch as a status indicator, and are all programmable via the IEEE interface.

POWER



Push on-push off applies line power to the instrument.

FILTER

Filter on (red light on) selects a low pass digital filter having an 8 second time constant.
Filter off (red light out) normal integration time 1 second.

SAMPLE

To initiate a single reading and hold it. A new reading is initiated every time the button is pressed.

CONTINUOUS

To initiate repeated measurements, each one updating the display. Mutually exclusive with SAMPLE.

°C/°F

Selects readings in either Centigrade (red light on) or Fahrenheit degrees.

REMOTE

Enables control by Remote commands via the IEEE interface, released for local operation.

RECORDER OUTPUT

Switches the Analog output on in normal resolution (red light on). Sensitivity is 5 V/100 degrees.

RECORDER GAIN X100

Switches the analog output on in high resolution (red light on). Sensitivity is 5 V/degree. 0.005V/1mK

RECORDER CALIBRATION

Selects fixed analog output signals to enable calibration of chart recorders, or verify recorder zero at any time during a run (red light on).

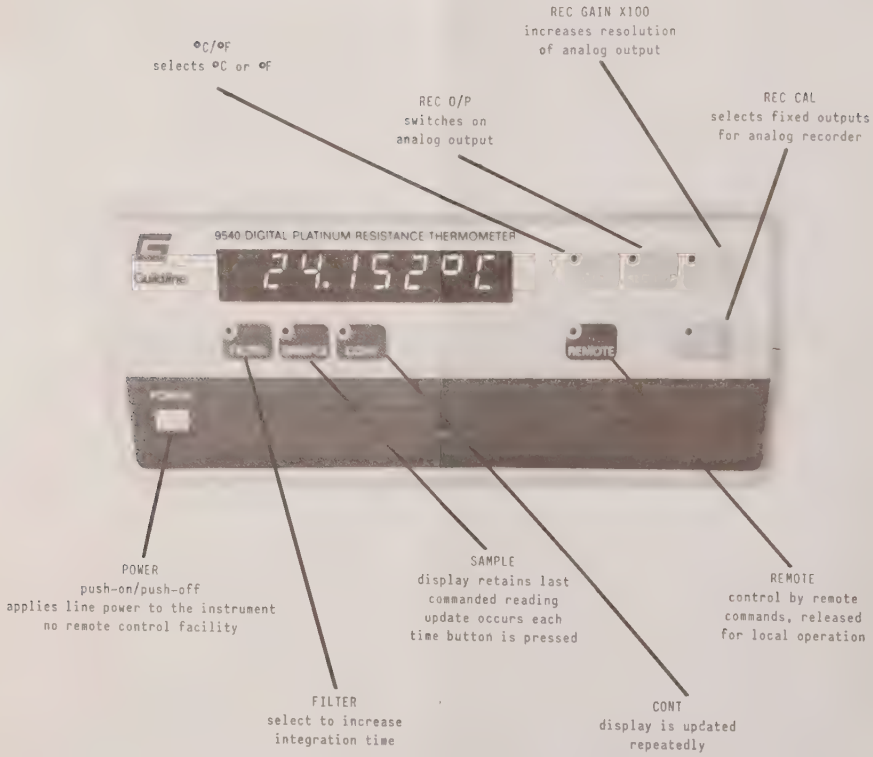
FRONT PANEL LOCKOUT

A facility known as FRONT PANEL LOCKOUT is not apparent from the front panel legends. Under the control of an external electrical command applied via the IEEE interface, the action of all front panel controls except POWER can be inhibited. This command signal even disables LOCAL and can be used to prevent unauthorized use of the thermometer when it is committed within a system.

NOTE

AN EXTERNAL COMMAND VIA THE IEEE, LOCAL LOCKOUT, CAN BE USED TO INHIBIT ALL FRONT PANEL CONTROLS EXCEPT POWER.

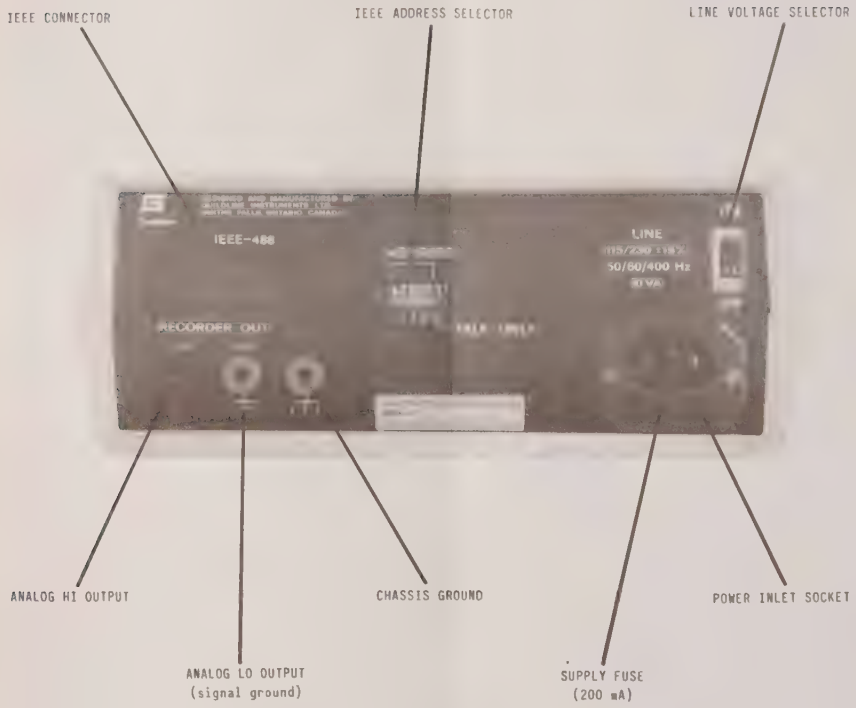
9540 FRONT PANEL



REAR PANEL CONNECTORS/CONTROLS

RECORDER OUT	Utilized to connect chart recorders.
IEEE-488	Utilized to connect to other devices / controllers on the General Purpose Interface Bus IEEE-488 STD (1978 revision).
INTERFACE ADDRESS	Selects IEEE-488 address between 0 and 31 and selects talk only or talker/listener mode.
LINE VOLTAGE	Selects line voltage, 115 V (up) or 230 V (down).
POWER INPUT	Accepts standard three core moulded line cord.

9540 REAR PANEL



DISPLAY

The display area is covered by a red monochromatic filter to inhibit stray or reflected light. From left to right the display information is:

a) Fixed minus sign when measuring a negative temperature.

b) Numeric indication, 7 bar segment light emitting diodes (LED's) are used to present the result of measurement, or other information.

c) Fixed decimal point positioned between third and fourth 7 segment LED's.

INVALID READINGS

An invalid reading is displayed as follows:-

This will occur if a measurement outside the specified limits of temperature is attempted. The limits are:-

degrees centigrade -200°C to +240°C

or

degrees fahrenheit -328°F to 464°F.

BUTTON ILLUMINATION

Button indicators are illuminated as a result of selecting the required functions. Button illumination also verifies the selected overall state of operation including control via the IEEE-488 interface.

REMOTE

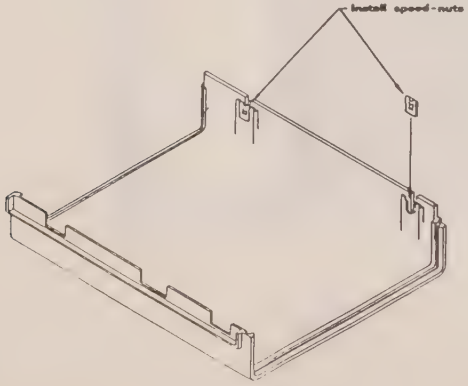
The Remote Button indicator is illuminated when the instrument is under remote control. Any initial command over the bus will illuminate the Remote Button indicator.

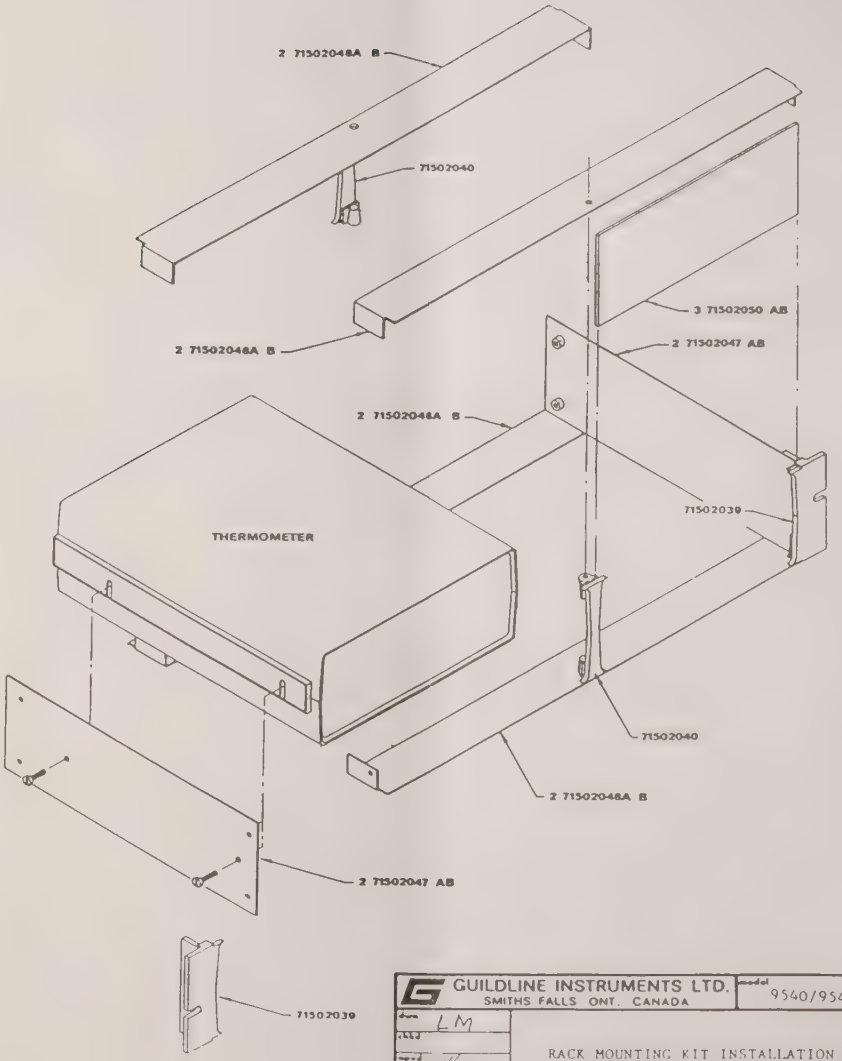
RACK MOUNTING

By use of the optional Rack Mounting Kit 18127.01.01 the 9540/9540B may be mounted singly or side by side with another 9540/9540B into a standard 19" rack. When using the Rack Mounting Kit the tilt handle must be removed by rotating all the way underneath the 9540/9540B until the base of the handle is positioned at the rear of the instrument. Then pull outwards at the pivots and remove. The four rubber feet must also be removed for rack mounting. These can be levered off with a small screwdriver. Remove the top cover of the 9540/9540B by releasing the four screws on the underneath. Put into the four recesses (2 on the RHS, 2 on the LHS) the speed nuts supplied with the Kit. Replace the top cover of the 9540/9540B and retighten the four screws.

ASSEMBLY OF THE RACK MOUNT ADAPTOR

Assemble the Rack Mounting Kit and complete the assembly except for the topstrip and one side panel for single mounting (or both side panels for side by side mounting). Slide in the 9540/9540B and fasten with the 1/2" (3 mm) screws. Complete the assembly of the side panel(s) and front top strip.





GUILDLINE INSTRUMENTS LTD. SMITHS FALLS ONT. CANADA	model 9540/9540B
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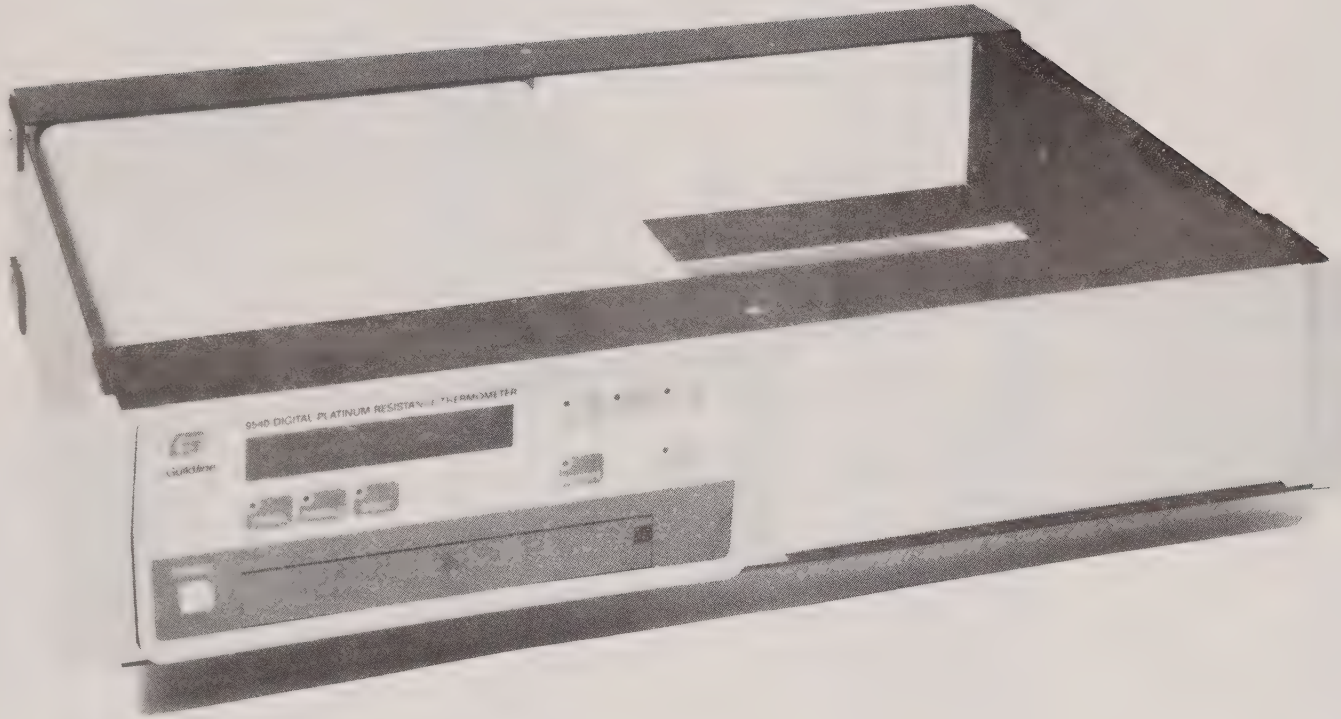
issued 28	
date 20 05 83	
scale	sheet 1 of 1 dwg no 18127.01.23 rev B



9540 INSTALLED IN RACK MOUNTING KIT

Chapter 2
Specifications

Specifications

TEMPERATURE

Accuracy: GUARANTEED PERFORMANCE including supplied probe.

Range	Resolution deg °C or °F	Limits of Error ± °C or °F		
		24 hrs. @ 23°C ± 1°C	90 days @ 23°C ± 5°C	1 Year @ 23°C ± 5°C
−200°C to −40°C −328°F to −40°F	0.001	**<2.0**	**<2.0**	**<2.0**
−40°C to +180°C −40°F to +356°F	0.001	0.01	0.015	0.03
+180°C to +240°C +356°F to +464°F	0.001	0.015	0.03	0.05

Total guaranteed performance is worst case. It assumes all contributing errors are maximum and occur at the same time and in the same direction. Contributing errors include calibration uncertainty which is referred to flowing water at the rate of 1 m/s, repeatability, stability, temperature coefficient, linearization plus sensor and electronics drift and probe self heating.

Temperature coefficient: . . . . . < ±0.0005 deg. C./deg. C.
< ±0.0009 deg. F./deg. F.

Repeatability: . . . . . ±2 least significant digits

Warm up time: . . . . . 30 seconds to full rated accuracy

Time constant: . . . . . 5 seconds

Self Heating: . . . . . < 0.015 deg. C. at 23 deg. C. in flowing water at 1 m/s

Filter: . . . . . 10 sec. digital filter

Speed: . . . . . 1.5 sec. per reading filter out

General

Power Supply:

voltage (switch selected):	95 to 130V or 190 to 260V
frequency:	50, 60, or 400 Hz
consumption:	< 10VA

Protection:

power supply:	fused line 100 mA slo blo

Environment:

Temperature, working:	0 to 50 deg. C.
storage:	−30 deg. to 70 deg. C.
Maximum operating humidity (non condensing):	70% at 40 deg. C.
Shock and Vibration:	1 g in 3 planes, resonance search 5 Hz to 200 Hz

Dimensions:

Height:	88 mm (3.46 in.)
Width (including handle):	228 mm (8.98 in.)
Depth:	278 mm (10.94 in.)
Weight:	3.0 kg (6.6 lbs.)

Sensor Dimensions:

Length:	210 mm (8.25 in.)
Diameter:	3 mm (0.1 in.)
Immersion depth:	50 mm (2 in.) minimum
Length of sensor cable:	2 m (6.5 ft.)
Sensor incapsulation:	Stainless steel

INTERFACE — built in as standard

Protocol and connection: IEEE 488 (1978)

Provides full talker/listener facilities and remote control of all functions.

Subset: SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP2, DC1, C0.

Chapter 3
Operating Instructions

PRELIMINARIES

Set the LINE input selector to the desired voltage, UP for 115 V, DOWN for 230 V. Remove the warning label positioned across the line input socket which indicates that the instrument left the factory set for 230 V operation.

Check that the correct fuse is fitted 200 mA Slo-Blo (GMA 2/10) for both 115 V (nominal) and 230 V (nominal) line voltage.

Only fuses with the rated current, and of the specified type, are to be used for replacement. Makeshift fuses should never be used.

The supplied moulded line cord should be plugged into the 3 pin receptacle socket on the rear of the instrument. The other end of the line cord must be plugged into a wall socket provided with a protective earth - this applies equally to the use of an extension cable. Where 3-contact supply outlets are not available a suitable protective earth connection must be made before switching the instrument on. Any interruption of the protective earth may possibly render the instrument unsafe.

Where the moulded plug on the supplied line cord does not match the outlet socket of the local service, the plug can be removed. The cable should then be stripped back and replaced with a 3-pin plug of the correct type.

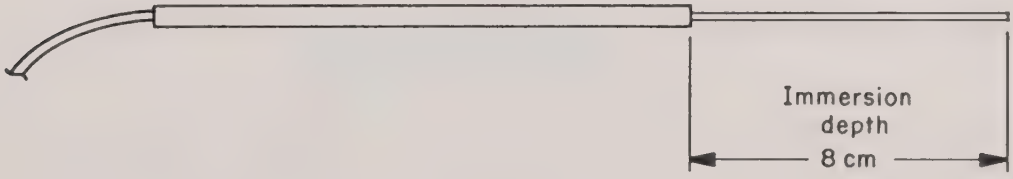
The plug should be wired as follows:-

BROWN	LIVE
BLUE	NEUTRAL
GREEN/YELLOW	EARTH

PRECAUTIONS

The instrument should be disconnected from the line supply before any attempt is made to remove the cover.

The integral platinum resistance probe of the 9540 should only be immersed in a fluid from tip to shoulder, approximately 8 cm.



Although of rugged stainless steel construction the probe is a precision sensor and requires careful handling due to its inherent sensitivity to physical shock. Dropped or severely knocked the probe could suffer a resistance shift necessitating instrument recalibration, or be broken completely.

Care should also be taken not to leave the 9540 instrument upside down for extended periods of time. A build up of liquids can occur in the probe enclosure due to the probe not having been wiped clean after use. Any fluid build up in the probe enclosure will not harm the 9540 in its normal upright position, however any immersion could be detrimental due to the possible ingress of fluids into the electronic circuitry.

After using the 9540 at very cold or very hot temperatures care should be taken not to handle the probe if removed from a fluid without wearing protective gloves on the hands, otherwise a severe burn could result.

OPERATING PROCEDURE

The Model 9540 is a direct reading digital instrument. The following procedure describes the steps to be taken in using the instrument.

POWER ON SEQUENCE

Apply power to the 9540 by depressing the front panel switch. Observe the following display.

The buzzer will also sound. These conditions will remain for approximatly 1 second.

Next observe that the digits are strobed individually from the left to right in the following manner:

Following the segment check, observe that the current IEEE address is displayed as follows, where XX is the selected address (shown as 08 set).

Finally observe that the display indicates 0°C and the 9540 is measuring temperature and is ready for use.

°C TEMPERATURE MEASUREMENT

1. Switch Power on.

2. Ensure REMOTE button indicator is off (i.e. local operation), unless REMOTE operation is required in which case refer to the appropriate part of the Manual.

3. °C/°F button indicator will be lit, indicating °C mode (default condition on power up).

4. Press SAMPLE for each single reading required or CONT for repetitive measurement.

5. Read the displayed value in °C from the display.

6. If the display indicates an invalid reading then the temperature being measured is outside the specified limits - see Section 2, SPECIFICATIONS.

7. If the readings displayed are noisy due to external interference, the filter can be selected to increase the integration time and stabilize the readings.

°F TEMPERATURE MEASUREMENT

1. Switch Power on.

2. Ensure REMOTE button indicator is off (i.e. local operation), unless REMOTE operation is required in which case refer to the appropriate part of the manual.

3. Press °C/°F button, indicator off, indicating °F mode.

4. Press SAMPLE for each single reading required or CONT for repetitive measurement.

5. Read the displayed value in °F from the display.

6. If the display indicates a valid reading then the temperature being measured is outside the specified limits - see Section 2 Specifications.

7. If the readings displayed are noisy due to external interference the filter can be selected to increase the integration time and stabilize the readings.

ANALOG RECORDING

To record temperature changes on an analog chart recorder connect a suitable chart recorder to the outputs on the rear of the 9540. Note that the REC CAL button has 4 positions used in both temperature recording and chart recorder calibration. Upon power up the REC CAL button is illuminated and set to its 1st position. FULL SCALE OUTPUT FROM THE 9540 IS ±10 V.

RECORDER CALIBRATION

1. With the 9540 switched on and reading in °C or °F a zero volt signal will be output from the recorder output terminals.

2. Observe that the REC CAL button is illuminated.

3. Adjust the chart recorder zero (or datum) to the required position on the paper.

4. Press REC CAL on the 9540 and a zero volt signal will be output from the recorder output terminals again.

5. Press REC CAL on the 9540 and a -10 V signal will be output from the recorder output terminals.

6. Adjust the chart recorder full scale deflection on the chart recorder paper.

7. Press REC CAL again and a +10 V signal will be output from the recorder output terminals.

8. Adjust the chart recorder positive full scale deflection position on the paper.

   Note: Some recorders are preset to a nominal 10 V input without full scale adjustments in either direction. For recorders of these types input attenuation will be required for full scale inputs of ±10 V.

9. Press REC CAL again and a zero volt signal will be output from the recorder output terminals.

   Note: The REC CAL button has now been set back to the 1st position.

10. Press REC CAL again and automatically, upon selection of either REC O/P or REC GAIN X100, the current temperature reading will be output as the set point equal to 0 V output, i.e. this defines the datum and can be any temperature over the full range of measurement.

11. If REC GAIN X100 sensitivity is required for high resolution investigation press REC GAIN X100.

12. If normal resolution is required press REC O/P.

13. If during a recording it is required to change the resolution from REC O/P to REC GAIN X100 or visa versa, a new REC CAL routine must be performed (steps 9 and 10 only). This redefines a new datum.

14. To recheck the zero (datum) at any time press REC CAL only once and then return to either REC O/P or REC GAIN X100 whichever was already in use.

IEEE-488 REMOTE CONTROL

The built-in IEEE-488 interface allows connection of the Model 9540 to the standard Instrumentation Bus. This allows remote control of all front panel settings, and remote readout of the full display. The interface has the following features:

-complete bus handshaking

-talk/listen mode for use with bus controllers, and talk-only mode for simple bus arrangements with another (listen-only) device.

-user selectable service request facility. Service request is issued on completion of a new reading.

-model 9540 can be reset to the power on state via the bus.

-complete front panel lockout.

The temperature measurements, both in Celsius and Fahrenheit degrees, are available via the interface bus with the same accuracy and resolution as displayed on the front panel. The interface has an interlocking scheme so that the data read by the bus controller is always the latest complete reading.

IEEE ADDRESS

For applications with a bus controller, put the TALK ONLY rear panel switch in the up position. Select a unique device address from Table 3.1 and set it on the rear panel address switches. Some bus controllers use ASCII characters to address instruments, while others use decimal codes in their software. In both cases an ASCII character is actually sent. Table 3.1 shows the relation between switches, decimal codes and ASCII TALK/LISTEN address.

CONNECTION

As this interface conforms to IEEE Std 488-1978 the connector has metric threaded retainer screws. These are identified by a black finish. Connect the thermometer to a bus controller and other instruments with bus cables which have black retainer screws only. Up to three cables may be piggybacked in a stack from the back panel of the Model 9540.

DEVICE DEPENDENT COMMANDS (See Table 3.2)

The Model 9540 accepts ASCII characters over the bus. In general each character causes the same action as a single front panel button command. A read command from the thermometer will take the number from the display, selected by °C/°F.

TABLE 3.1 ADDRESS SWITCH SETTING FOR BUS ADDRESS

Address Switch Setting Switch #					Decimal Value	ASCII Characters	
1	2	4	8	16		My Listen Address	My Talk Address
0	0	0	0	0	0	SP	@
1	0	0	0	0	1	!	A
0	1	0	0	0	2	"	B
1	1	0	0	0	3	#	C
0	0	1	0	0	4	$	D
1	0	1	0	0	5	%	E
0	1	1	0	0	6	&	F
1	1	1	0	0	7	'	G
0	0	0	1	0	8	(	H
1	0	0	1	0	9	)	I
0	1	0	1	0	10	*	J
1	1	0	1	0	11	+	K
0	0	1	1	0	12	,	L
1	0	1	1	0	13	-	M
0	1	1	1	0	14	.	N
1	1	1	1	0	15	/	O
0	0	0	0	1	16	0	P
1	0	0	0	1	17	1	Q
0	1	0	0	1	18	2	R
1	1	0	0	1	19	3	S
0	0	1	0	1	20	4	T
1	0	1	0	1	21	5	U
0	1	1	0	1	22	6	V
1	1	1	0	1	23	7	W
0	0	0	1	1	24	8	X
1	0	0	1	1	25	9	Y
0	1	0	1	1	26	:	Z
1	1	0	1	1	27	;	[
0	0	1	1	1	28	<	\
1	0	1	1	1	29	=	]
0	1	1	1	1	30	>	↑

*1 1 1 1 1 is not allowed

1 is on, 0 is off

TABLE 3.2 DEVICE DEPENDENT COMMANDS

°C	SEND	C	
°F	SEND	F	
FILTER	SEND	T	;to reset filter send another T
CONT	SEND	R	;sending an R resets SAMPLE
SAMPLE	SEND	S	;sending an S resets CONT
REC OP	SEND	0	;note sending a "0 clears REC CAL
REC CAL	SEND	A	;sending A sets analog output to
			;0 V
		A	;sets analog output to -10 V
		A	;sets analog output to +10 V.
		A	;sets analog output back to 0 V.
RECS X100	SEND	X	;to select RECS X100 first send a
0			
			;for rec O/P
SRQ	SEND	Q	;sets Service request

DATA FORMAT

+ 1 2 3 4 5 6 E - 3 C C/R L/F

is typical of the format for a reading of the display selected by either °C or °F.

NOTE: The thermometer must be in the "remote" state before it will send readings over the bus. To put into "remote", send at least one command. REMOTE will light and then the display can be read over the bus.

DEVICE CLEAR

The interface also accepts the IEEE-488 selected device clear SDC or device clear DCL commands. Receipt of either of these commands causes the Model 9540 microprocessor to restart and initialize the program. These commands have the same effect as turning the instrument off and on except that the thermometer is not powered down. This process is useful for resetting the bus if it becomes hung up.

If the thermometer does not seem to respond to device dependant commands, send a DCL, (for example clr 7 on an HP9825). The front panel LED's and display should go through the sequence described in the Operating Procedure. If the 9540 responds then send an SDC (eg clr 708). If this is ignored then it is likely that the wrong address is set on the rear panel switch.

NOTE: In REMOTE, none of the controls or switches on the front or rear panel (except for REMOTE) is operable. To change the address or talk only switch, the 9540 must go through the power up routine for any change to be recognized. SDC or DCL lets you reinitialize the thermometer.

LOCAL LOCKOUT

Ordinarily in REMOTE, the front panel is de-activated except for REMOTE. Depressing this control will return the instrument to local front panel operation. However, the bus controller may send the bus command LLO (local lockout). In this case the REMOTE button is also inoperative. To regain local control send a GTL (go to local) command from the bus controller or remove the REN (remote enable) signal from the bus, or turn the power off and on.

STATUS BYTE

Table 3.3 shows the status byte which is the Model 9540's response to a serial poll.

a) Bit 7 is set high when the requested measurement is ready. Each time the Thermometer updates the coresponding display, bit 7 is set. The bit is cleared when the controller reads the result.

b) Bit 6: Service Request is set for each reading if an S command has been sent. Reading the statusbyte clears this bit after the read operation is completed.

c) Bits 4,5 are unused.

d) Bit 3: Overrange corresponds to the display flashing.

e) Bit 2: Busy when the A/D is in the middle of a reading.

f) Bit 1:

g) Bit 0: Set by any character not in table 3.3. Any valid command will clear bit 0.

SERVICE REQUEST

The Thermometer can assert SRQ on the bus after a reading is complete. Send for example "CQ" to the instrument. When the next reading is taken, it will set both Bit 6 and Bit 7 of the status byte and put SRQ on the bus. This event can interrupt a controller which will conduct a serial poll and find bit 6 of the Model 9540 status byte set. It is up to the controller to take action by reading from the interface. To turn off further SRQ's, send DCL or SDC.

Example

To read from the Thermometer, it must be in the remote state: Send any of the device dependent commands; REMOTE will come on.

eg:	send	F
	read	Fahrenheit degrees
	send	T
	read	Filter
	send	Ct
	read	Centigrade degrees and filter off

TALK ONLY MODE

For the user who wishes mearly to obtain a hard copy print out of measurement data, the 9540 can function as a simple talker only device. A printer or similar IEEE device is simply connected via the bus to the 9540. The talk only switch on the 9540 must be set in the down position (TALK ONLY) and the printer must be set to LISTEN ONLY. The 9540 can then be operated normally, under LOCAL control, and measured temperature presented to the printer.

TABLE 3.3 STATUS BYTE

Status Byte Response to Serial Poll			
	7		Reading done
	6		Service Request
	5	X	
	4	X	
	3		Overrange
	2		Busy: reading not yet valid
	1	X	
	0		Unrecognized command

SAMPLE READINGS USING HP9825 AS A BUS CONTROLLER

PROGRAM 1

Test 1,
Taking a single reading

```
0:  fxd 3
1:  clr 708
2:  wrt 708,"S"
3:  red 708,A
4:  prt A
```

```
100.004
```

PROGRAM 2

Test 2,
Taking 5 consecutive readings.

```
0:  fxd 3
1:  wrt 708,"S"
2:  red 708,A
3:  prt A
4:  I + 1 → I
5:  if I#5;gto 1
```

```
100.025
100.024
100.024
100.023
100.022
```

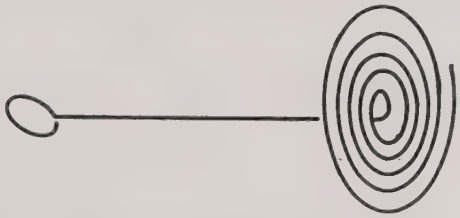
Chapter 4
Reference Temperature

The 9540's measurement specification can be verified using the following procedure. The optimum two points for the calibration of of this instrument, i.e. the primary reference temperatures are 0°C and 164°C.

PREPARATION OF A SUITABLE ICE BATH FOR CHECKING THE ICE POINT

Correct and careful preparation of an ice bath is extremely important to prevent the ice point variation from being too large. Errors of 0.01°C are common in ice baths due to poor preparation. The following procedure, if carefully followed, should produce an ice point within 0.0005°C of the true value. The equipment required for ice point checking is as follows.

a) A wide mouth dewar flask about 8 cm (3") I.D. and 25 cm (10") deep.
b) A larger dewar of approximately 15 cm (6") I.D. and 40 cm (15") deep.
c) A source of clean and pure shaved ice.
d) A new, unused pail to hold the shaved ice which will never be used for anything else.
e) Pure water, either distilled or de-ionized.
f) An aluminum or stainless steel stirrer shaped as shown in the sketch.



g) A pair of light rubber gloves.

It is extremely important that all equipment be clean and rinsed to eliminate any contamination. The ice should not be touched by the hands at any time but washed rubber gloves can be used, provided they do not touch the outside of any containers after washing. Even then, avoid handling the ice that touches the stem of the thermometer. The ice is best made from distilled water or in an ice machine that does not freeze all of the water; the freezing process helps in the purification and concentrates the impurities in the overflow. With commercial ice frozen in large blocks the center of the block should not be used, only the clear outer layers which are frozen first.

Carefully clean the utensils, stirrer and thermometer with mild detergent solution, then rinse two or three times with tap water and finally with distilled water. In preparation for taking a measurement at ice point, pre-cool the 9540 probe in shaved ice. Fill the larger dewar 2/3 full with distilled water and add shaved ice, using the stirrer. Stir briskly to make a slush mixture. This mixture should be thin enough that the stirrer will pass through it easily, but thick enough that some ice can be picked up on the stirrer when lifted out slowly. Using the stirrer, transfer the slush-ice to the smaller dewar, to within 5 cm of the top. Add distilled water (precooled to ice point by adding ice), just to cover the slush mixture (too much will float the ice, which must be avoided). Thrust the pre-cooled 9540 probe deep into the center of the ice mixture but no closer than 5 cm from the bottom of the ice. Check the reading of the 9540 and verify that it is within its specifications at 0°C.

NOTE

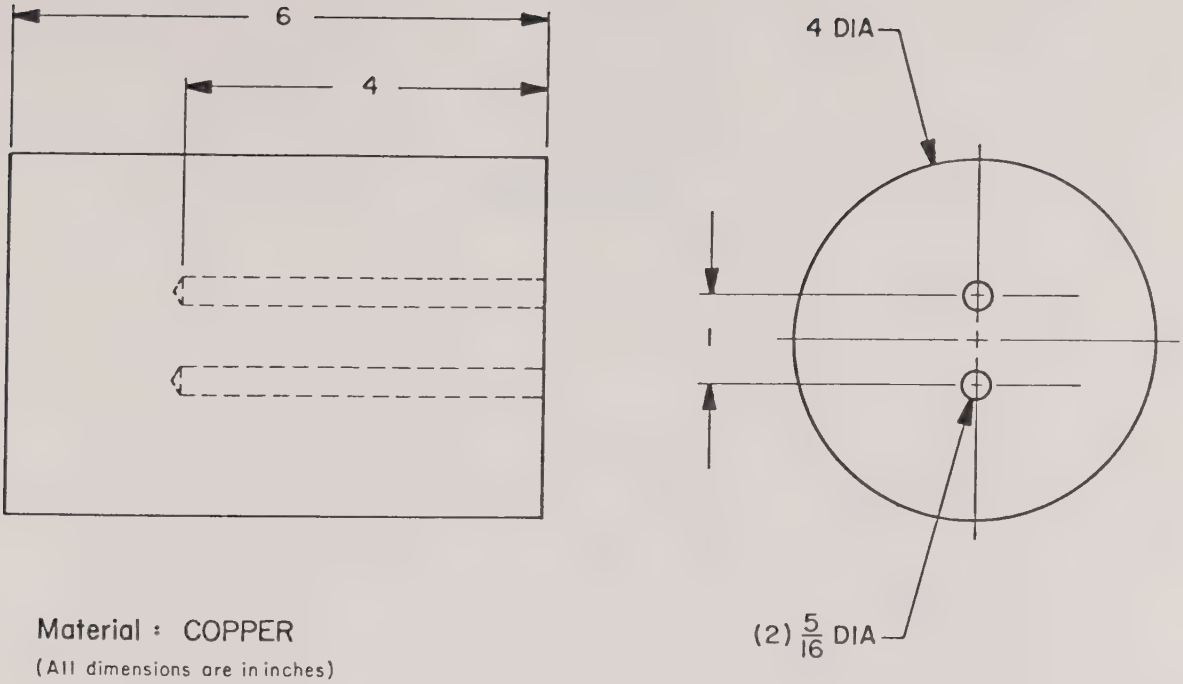
Occasionally an ice point appears to pass through a minimum, then give a slow rise followed by an almost flat region. This is usually caused by soluble salts on the equipment dissolving in the solution causing a depression of the ice point which diminishes as diffusion and melting dilute the solution. The second ice point is usually higher when this happens. If differences arise, ice point checks should be continued with every precaution until several successive readings agree.

164°C REFERENCE TEMPERATURE

The unit is factory calibrated at the 164°C point for linearity and gain. The use of a high temperature bath, a copper PRT holding block, a standard PRT and an instrument more accurate than the 9540 is required to verify the temperature of the bath to ±2 mK.

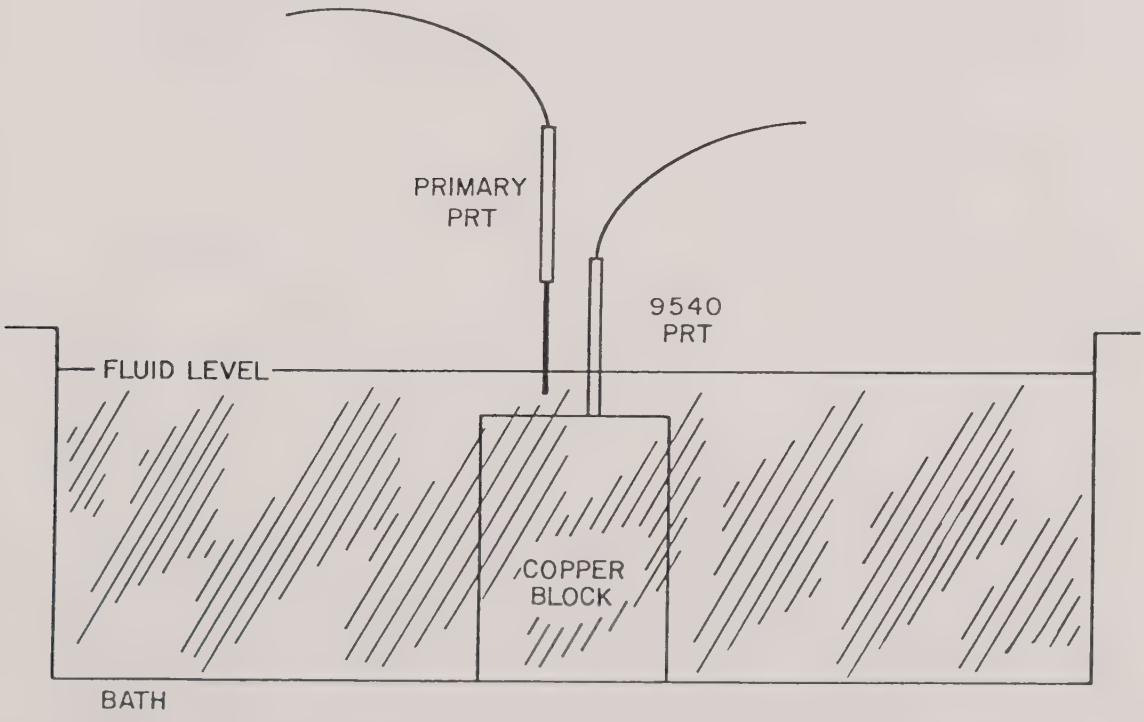
The copper holding block should be six inches in height and four inches in diameter. Two 5/16" diameter holes should be drilled in the center of the block, one inch apart and four inches deep. The block should be placed in the bath and allowed to stabilize for approximately one hour. Ensure that there is fluid flowing over the top of the block. The temperature differential of the inside of the block between the two holes should be less than 1 mK.

Insert the standard PRT and the 9540 PRT into the two holes of the copper holding block. Allow to stabilize for approximately 10 minutes. Verify the temperature using the standard PRT and measuring apparatus. Verify that the 9540 is within its specification at 164°C.



Material : COPPER

(All dimensions are in inches)



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